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EXAMINER
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TSANG FOSTER, SUSY N

ART UNIT	PAPER NUMBER
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1745

DATE MAILED: 08/26/2003

13

Please find below and/or attached an Office communication concerning this application or proceeding.

ASB

**Office Action Summary**

Application No.

09/721,519

Applicant(s)

SKOTHEIM ET AL.

Examiner

Susy N Tsang-Foster

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 03 June 2003.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-83 is/are pending in the application.
- 4a) Of the above claim(s) 17-36 and 63-83 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-9, 11-16, 37-46, and 48-62 is/are rejected.
- 7) ☒ Claim(s) 10 and 47 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.  
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All   b) ☐ Some \* c) ☐ None of:  
1. ☐ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).  
\* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).  
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

- 1) ☐ Notice of References Cited (PTO-892)                      4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)                      5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_                      6) ☐ Other:

## DETAILED ACTION

### *Response to Amendment*

1. This Office Action is responsive to the amendment filed on 6/3/2003. Claims 1 and 37 have been amended. Claims 12, 55, and 58-60 are objected to because these claims have been unintentionally amended (for example, typographical errors) and are not original claims.

Claims 1-83 are pending. Claims 17-36 and 63-83 remain withdrawn from consideration. Claims 10 and 47 are objected to. Claims 1-9, 11-16, 37-46, and 48-62 are finally rejected for reasons of record which are reiterated below for applicant's convenience.

### *Claim Objections*

2. Claims 12, 55, and 58-60 are objected to because of the following informalities: Claims 12, 55, and 58-60 are objected to because these claims have been unintentionally amended (for example, typographical errors) and are not original claims.

In claim 12, the word "polyroer" should be "polymer".

In claim 55, the word "xerogellayer" should be "xerogel layer".

In claim 58, line 2, the number 15 was not in the original claim because it was a line number.

In claim 58, the term " $-S_m^-$ " was originally " $-S_m^-$ ".

In claim 59, line 2, the number 20 was not in the original claim because it was a line number.

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In claim 60, line 2, the number 25 was not in the original claim because it was a line number.

Appropriate correction is required.

### *Duplicate Claims*

3. Applicant is advised that should claim 58 be found allowable, claim 59 will be objected to under 37 CFR 1.75 as being a substantial duplicate thereof. When two claims in an application are duplicates or else are so close in content that they both cover the same thing, despite a slight difference in wording, it is proper after allowing one claim to object to the other as being a substantial duplicate of the allowed claim. See MPEP § 706.03(k).

### *Claim Rejections - 35 USC § 102*

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claims 1, 2, 37-40, 54, 56, 61, and 62 are rejected under 35 U.S.C. 102(b) as being anticipated by Shackle et al. (US 5,436,091).

Shackle et al. disclose a solid state alkali metal anode primary or secondary cell comprising an alkali metal anode layer, a solid ionically conductive electrolyte layer; a cathode composition layer; and a current collector where the electrolyte is interposed between the alkali

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metal anode layer and the cathode layer (col. 2, lines 45-66, col. 4, lines 24-31 and Figure 1).

The preferred electrolytes are solutions of an ionizable alkali metal salt, an aprotic solvent (nonaqueous solvent) and a polymerizable compound (col. 5, lines 45-52). The alkali metal anode layer may take the form of a lithium foil, a lithium coated foil such as copper foil having a layer of lithium deposited on its surface (col. 5, lines 34-40). The copper foil inherently is capable of forming an alloy with lithium metal or is inherently capable of diffusing into the lithium metal according to applicants' specification.

Shackle et al. also disclose that cathode materials are known in the art (col. 6, line 59) and give examples of electroactive metal chalcogenides in column 7, lines 1-7 of the reference.

During electrochemical cycling of the cell, the copper foil inherently forms an alloy with the lithium metal foil. Furthermore, prior to electrochemical cycling of the cell, the copper foil inherently forms an alloy with the lithium foil over time during storage of the electrochemical cell.

6. Claims 1, 2, 4, 5-7, 9, 11, 12, 14, 15, 37, 38, 39, 40, 42, 43, 44, 46, 48, 49, 51, 52, 54, 55, 56, and 61 are rejected under 35 U.S.C. 102(b) as being anticipated by Kawakami et al. (US 5,824,434).

Kawakami et al. disclose a lithium secondary battery (electrochemical cell) comprising a negative electrode, a separator, and the battery has a stacking pattern that includes a conductor layer 003 between the negative electrode and the separator (see Figure 9D and col. 24, lines 31-41). Figure 9 D shows that a conductor layer 003 is formed on the negative electrode layer 001

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and an electrolytic solution layer 006 is formed on the conductor layer 003 and a separator layer 004 is formed on the electrolytic solution layer 006.

Kawakami et al. also disclose that the conductor layer can be made of copper (col. 24, lines 38-41). The thickness of the conductor layer can be from 5 nm to 1000 nm (col. 43, lines 45-46). The negative electrode layer can be a lithium metal (col. 2, lines 14-34) and a specific example is given where lithium metal foil is pressed onto a titanium mesh current collector (substrate) prior to depositing a conductor film on the surface of the lithium metal foil of 20 nm (col. 70, lines 7-21). The electrolytic solution layer is formed by using a polymer as a gelling material that swells when it absorbs solvent of the electrolytic solution and the polymer can be polyethylene oxide, polyvinyl alcohol and polyacrylamide (col. 20, lines 33-39). Kawakami et al. also discloses separator for a lithium can be made of polypropylene (col. 46, lines 20-25).

During electrochemical cycling of the cell, the copper conductor layer inherently forms an alloy with the lithium metal layer. Furthermore, prior to electrochemical cycling of the cell, the copper metal layer inherently forms an alloy with the lithium metal layer over time during storage of the electrochemical cell.

### ***Claim Rejections - 35 USC § 103***

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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8. Claims 8 and 45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kawakami et al. (US 5,824,434) as applied to claims 6 and 43 above, and further in view of Chu et al. (US 6,402,795 B1).

Kawakami et al. disclose all the limitations of claims 8 and 45 except that the negative electrode (anode) further comprises a substrate that is a metallized polymer film. Instead, Kawakami et al. disclose a titanium mesh current collector (see above).

Chu et al. teaches that a current collector is provided as a metallized plastic layer because it can be much thinner than a free-standing current collector (col. 5, lines 55-65).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use a metallized polymer film as the current collector instead of the titanium mesh current collector because the metallized polymer film can be much thinner than a titanium mesh current collector and a thinner and lighter battery would result.

9. Claims 13 and 50 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kawakami et al. (US 5,824,434) as applied to claims 11 and 48 above, and further in view of Shackle (US 5,037,712).

Kawakami et al. disclose all the limitations of claims 13 and 50 except that the electrolytic layer containing polyethylene oxide (PEO) is crosslinked (see above).

Shackle teaches that polyethylene oxide in a solid electrolyte is crosslinked in order to form a solid matrix through which the ionically conducting liquid interpenetrates to provide continuous paths of high conductivity in all directions through the matrix (see abstract).

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It would have been obvious to one of ordinary skill in the art at the time the invention was made to crosslink the polyethylene oxide in the electrolytic layer (the third layer) in order to increase the ionic conductivity of the third layer that would improve battery performance.

10. Claims 3 and 41 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kawakami et al. (US 5,824,434) as applied to claims 1 and 37 above, and further in view of Tonder et al. (US 5,435,054).

Kawakami et al. disclose all the limitations of claims 3 and 41 except that the thickness of the anode layer is 2 to 100 microns (see above).

Tonder et al. teach that it is particularly favorable to use lithium foil of anode thickness of about 75 microns in a lithium laminar battery (col. 1, lines 10-20).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use 75 micron thick lithium foil in the anode layer of the battery of Kawakami et al. because this layer of thickness produces a thin laminar battery suitable for a particular electronic application and the thickness of the lithium foil is also determined by the amount of active material needed to meet the capacity needs of the electronic application.

11. Claims 57-60 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kawakami et al. (US 5,824,434) as applied to claim 37 above, and further in view of WO 99/33125.

Kawakami et al. disclose all the limitations of claims 57-60 (see above) except that the cathode active material in the lithium battery is a sulfur-containing material selected from



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elemental sulfur, an electroactive sulfur-containing polymer where the sulfur-organic polymer in its oxidized state comprises one or more polysulfide moieties,  $-S_m-$  where  $m$  is an integer equal to or greater than 3, an electroactive sulfur-containing polymer where the sulfur-organic polymer in its oxidized state comprises one or more polysulfide moieties,  $-S_m^-$  where  $m$  is an integer equal to or greater than 3, and an electroactive sulfur-containing polymer where the sulfur-organic polymer in its oxidized state comprises one or more polysulfide moieties,  $-S_m^{2-}$  where  $m$  is an integer equal to or greater than 3.

WO99/33125 teaches that the cathode material of a lithium secondary battery can be transition metal chalcogenides, conductive polymers, and sulfur-containing materials (page 10, lines 16-20) and that the sulfur-containing materials can be elemental sulfur (page 10, lines 21-22), an electroactive sulfur-containing polymer where the sulfur-organic polymer in its oxidized state comprises one or more polysulfide moieties,  $-S_m-$  where  $m$  is an integer equal to or greater than 3 (page 10, lines 24-26), an electroactive sulfur-containing polymer where the sulfur-organic polymer in its oxidized state comprises one or more polysulfide moieties,  $-S_m^-$  where  $m$  is an integer equal to or greater than 3 (page 11, lines 5-13) and an electroactive sulfur-containing polymer where the sulfur-organic polymer in its oxidized state comprises one or more polysulfide moieties,  $-S_m^{2-}$  where  $m$  is an integer equal to or greater than 3 (page 11, lines 5-13).

It would have been obvious to one of ordinary skill in the art at the time that the invention was made to use the sulfur containing materials recited in WO 99/33125 in the cathode of the lithium battery of Kawakami et al. because sulfur cathode active materials in combination with lithium provides are known to provide the highest energy density possible in a battery on a

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weight or volume basis of any of the known combination of active materials and high capacity is beneficial for portable electronic device applications.

12. Claims 16 and 53 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kawakami et al. (US 5,824,434) as applied to claims 14 and 51 above, and further in view of Gozdz et al. (US 5,429,891).

Kawakami et al. disclose all the limitations of claims 16 and 53 except that the separator (fourth layer) is crosslinked.

Gozdz et al. teach the use of separators comprising a crosslinked hybrid electrolyte film comprising a copolymer of vinylidene fluoride and hexafluoropropylene in lithium batteries that are strong, flexible and function over a temperature range extending well above and below room temperature where the copolymer comprises 8 to 25 wt% hexafluoropropylene (col. 2, lines 42-57 and col. 3, lines 20-28).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the separator of Gozdz et al. comprising a crosslinked hybrid electrolyte film comprising a copolymer of vinylidene fluoride and hexafluoropropylene in the amount of 8 to 25 wt% of hexafluoropropylene in the copolymer because the separator is strong, flexible and functions over a temperature range extending well above and below room temperature.

#### ***Double Patenting***

13. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or

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improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and, *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

14. Claims 1 and 2 are provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claim 21 of copending Application No. 10/025,651. Although the conflicting claims are not identical, they are not patentably distinct from each other because claim 21 of the copending application recites an anode of an electrochemical cell comprising an anode active layer comprising lithium and a metal current collector comprising copper in contact with the lithium layer which meets the limitations of claims 1 and 2 of the present application. The limitations of claim 21 of the copending application includes the limitations of instant claims 1 and 2 of the present application and therefore claim 21 of the copending application anticipates instant claims 1 and 2.

This is a provisional obviousness-type double patenting rejection because the conflicting claims have not in fact been patented.

#### ***Response to Arguments***

15. Applicant's arguments filed 6/3/2003 have been fully considered but they are not persuasive.

In response to applicant's assertion that the copper foil of the anode layer of Shackle is not temporary, the Examiner has interpreted the term "temporary" to the broadest reasonable extent that is consistent with the specification. The applicant states in the specification on page 3 that a temporary protective material is a temporary protective metal that is capable of forming an alloy with lithium metal or is capable of diffusion into lithium metal and gives copper as an example of a temporary protective metal. Since Shackle discloses a copper layer on the lithium foil, the copper metal layer inherently is capable of alloying with the lithium metal or is capable of diffusing into the lithium metal. The term "temporarily protective metal layer" encompasses part of the copper foil that is diffused into the lithium metal layer and does not require that the entire copper foil layer of the current collector be diffused into the lithium metal layer. A certain thickness of the copper foil layer is capable of being diffused or alloyed with the lithium foil layer.

In response to applicant's assertion that if the copper layer was temporary, the anode would lose structural integrity in use, during charge and discharge cycles and in storage, the term "temporary" has not been limited in the specification to a certain time scale during which the temporary protective metal must be diffused into the lithium metal layer. The lifetime of the battery can be longer than the time it takes for the copper foil layer of the current collector to completely diffuse into the lithium foil layer and structural integrity of the battery would be preserved during the lifetime of the battery.

In response to applicant's assertion that applicant did not teach that in all circumstances a copper layer will be temporary, applicant did not explicitly exclude all circumstances in the specification in which a copper layer will not be temporary.

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In response to applicant's assertion that Kawakami does not disclose, teach, or suggest that the copper conductor layer is temporary and that the Examiner's arguments on the inherency of alloying is based on applicant's disclosure, the Examiner points out the thickness of the copper metal layer falls within the claimed range and inherently must be capable of alloying with or diffusing into the lithium metal layer over time and during the charge and discharge cycle of the lithium battery even though this inherent feature is not recognized in the prior art.

In response to applicant's assertion that the use of the applicant's specification to support a rejection is incorrect since it relies on more than a single reference to establish the anticipation rejection, the Examiner disagrees with this assertion since the specification has been used as a dictionary for the term "temporary protective metal" in the claims since the term "temporary protective metal" is not a standard term in the art. The Examiner did not apply applicant's specification in the prior art rejections but merely used the specification as a reference for the term "temporary protective metal" as defined by applicant.

*Allowable Subject Matter*

16. Claims 10 and 47 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

17. The following is a statement of reasons for the indication of allowable subject matter:

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The distinguishing feature of the present invention is that third layer in contact with the second layer on a side opposite the first layer is a single ion conducting layer comprising a glass selected from the group consisting of lithium silicates, lithium borates, lithium aluminates, lithium phosphates, lithium phosphorus oxynitrides, lithium silicosulfides, lithium germanosulfides, lithium lanthanum oxides, lithium tantalum oxides, lithium niobium oxides, lithium titanium oxides, lithium borosulfides, lithium aluminosulfides, lithium phosphosulfides and combinations thereof.

The closest prior art of record, Kawakami et al. disclose that the third layer in contact with the conductor layer is an electrolytic solution layer and do not disclose, teach, or suggest that the third layer is a glass selected from the group consisting of lithium silicates, lithium borates, lithium aluminates, lithium phosphates, lithium phosphorus oxynitrides, lithium silicosulfides, lithium germanosulfides, lithium lanthanum oxides, lithium tantalum oxides, lithium niobium oxides, lithium titanium oxides, lithium borosulfides, lithium aluminosulfides, lithium phosphosulfides.

### *Conclusion*

18. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period

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will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

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Any inquiry concerning this communication or earlier communications should be directed to examiner Susy Tsang-Foster, Ph.D. whose telephone number is (703) 305-0588. The examiner can normally be reached on Monday through Thursday from 9:30 AM to 8:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick Ryan can be reached at (703) 308-2383. The phone number for the organization where this application or proceeding is assigned is (703) 305-5900.

The fax phone numbers for the organization where this application or proceeding is assigned is (703) 872-9310 for regular communications and (703) 872-9311 for After-Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.

st/ 

Susy Tsang-Foster  
Primary Examiner  
Art Unit 1745